Clermont County Office of Environmental Quality
2007 Water Quality Sampling Final Report

Introduction

In 1996, Clermont County established a monitoring program to characterize surface water quality within the county. Data collected through this program allow the county to analyze watershed conditions, identify potential water quality problems, support planning and management programs, and track trends and progress over time. Marking the twelfth year of the program, the 2007 sampling schedule was designed with these goals in mind, and consisted of four distinct, yet related components. The first involved bi-weekly collection of grab samples from Shayler Run, Hall Run and Wolfpen Run in the lower East Fork Little Miami River watershed. These samples were analyzed for nitrite-nitrate (NO_2-NO_3), dissolved ortho-phosphates (ortho-P), total phosphorus (TP), total suspended solids (TSS), and *E. coli*. Results of these analyses will be compared to past and future data to track trends within the watershed over time. Also, effluent samples were collected on the same bi-weekly schedule from a number of semi-private sewage treatment plants. In addition to the large municipal sewage treatment plants, which are regulated by the Ohio EPA (OEPA) through a permitting process, there are a number of small package plants serving mobile home parks, summer camps, schools, golf courses, and other properties throughout the county. Depending on the volume of water they treat, these plants may or may not be individually permitted by OEPA. This summer, effluent samples were collected from a number of these facilities in order to determine what contribution, if any, they are making to pollutant loads in the county's rivers and streams.

The second component of the 2007 sampling program involved investigating potential illicit discharges into the surface waters within Clermont County by conducting dry weather sampling above and below suspected discharges. By sampling under low-flow conditions, any water quality issues can be more easily identified with specific point source discharges, as opposed to the more diffuse, non-point source runoff associated with storm events. Areas targeted for this study included the community of Newtonsville and the Horner Run watershed in Miami Township. Samples in this study were analyzed for the same parameters as those in the ambient sampling program.

The third component of the county's water quality monitoring program in 2007 involved the collection of water samples at the county's long-term monitoring stations located on Shayler Run (SHYLER1.7) and Hall Run (HALL0.2) during storm events (wet weather sampling). Unlike the dry weather sampling described above, which is aimed at identifying specific sources of illicit discharge, the wet weather sampling is intended to quantify the cumulative impacts of major rain events, which serve to flush contaminants such as chemicals from agricultural applications, oil and gas from parking lot run-offs and other contaminants that cannot be identified as coming from any specific point (hence the term non-point source pollution). These types of stressors primarily enter streams during and immediately after rainstorms, and this component of the sampling program is intended to capture these events. In this way, the county can determine the

magnitude of these non-point source loadings, and monitor the effectiveness of programs designed to eliminate or reduce them.

Samples were collected using an ISCO 6700 series refrigerated autosampler. The autosampler was programmed to collect six sets of samples collected at one and one-half hour intervals after the stream exceeded a pre-determined level. These samples were then aggregated into three composite samples representing the rise, peak, and fall of the stream in response to the storm event. Level and rainfall data were also recorded at the stations using an ISCO 4220 submerged probe flow meter and an ISCO 670 tipping-bucket rain gauge, respectively. Samples collected by the autosampler were analyzed for NO_2-NO_3, ortho-P, TP, TSS, and *E. coli*.

Extreme drought conditions existed throughout Clermont County for most of the May-October sampling season, limiting the number of wet weather events that could be sampled. Wet weather sampling did occur at both the Hall Run and Shayler Run autosampler stations on May 16, 2007. An examination of the hydrograph for Hall Run indicated that, due to the extremely rapid rise in stream level, sampling began at the "peak" of the event. Therefore, only the "peak" and "fall" samples were collected. During a second wet weather event on July 10th, the autosampler at Hall Run failed to trigger, but all three samples were collected successfully at Shayler Run. During another storm event on September 27th, the Hall Run autosampler successfully collected the first sample, but subsequent sampling events did not occur because the autosampler failed to detect liquid in the sampling line. This was probably due to the fact that the intake for the autosampler was beneath several inches of sediment. For some reason, the sixth and final sample was collected successfully. Therefore, only the "rise" and 'fall" samples were collected at this location. The final wet weather event of the season occurred on October 16th, and all three samples were collected successfully at both the Hall Run and Shayler Run locations.

In the fourth and newest component of its water quality monitoring program, Clermont County was able to perform 24-hour Dissolved Oxygen (DO) profiles in several locations within the County in 2007, due to the acquisition of battery-powered YSI datasondes with internal memory that allow continuous, unattended deployment. One of the requirements of a grant between the Ohio EPA and the Clermont County Soil and Water Conservation District is the collection of three 24-hour DO profiles in Wolfpen Run. The extreme drought conditions experienced during the sampling season made it impossible to collect three complete profiles, as the stream was dry to prolonged periods. While the few rain events that did occur during the season restored flow to the stream, there was seldom a 24-hour period between the time the stream reached low-flow conditions (the preferred state for this type of sampling) and ran dry. Therefore, only one complete 24-hour survey was collected.

Efforts were also undertaken to collect 24-hour DO profiles above and below the Batavia, Middle East Fork and Lower East Fork wastewater treatment plants. These plants discharge into the East Fork Little Miami River, and 24-hour DO profiles performed under summer low-flow conditions should show whether or not the nutrients being added to the river from the treatment plant effluents are impacting downstream water quality in

the form of low DO levels. This phenomenon can occur when high nutrient levels promote excessive algal growth, and the subsequent die-off and decay of the algae robs the water column of dissolved oxygen. Equipment problems led to several false starts, but 24-hour profiles were successfully conducted above and below all three plants.

This report summarizes the results of these four components of the county's 2007 sampling program. No biological sampling was performed by Clermont County in 2007.

Ambient Sampling - Streams

Weather and Stream Conditions During Sampling

Samples collected from the Hall Run, Shayler Run and Wolfpen Run locations were characterized as either "dry" or "wet" samples, based on the amount of precipitation received over the 48 hours preceding sample collection. If less than 0.1 inches of rain fell in the 48 hours before the time of sampling, the sample was classified as a dry weather sample. If 0.1 inches of rain or more fell during the 48 hour period, the sample was categorized as a wet weather sample. The sample set dates and categories are provided in Table 1 below.

By identifying the weather conditions preceding each sampling event, it is hoped that contaminant concentrations can be linked to base- or low-flow conditions, or high-flow associated with storm water run-off, thus providing valuable diagnostic information regarding potential source(s) of pollution. However, because this component of the county's sampling program involves set bi-weekly sampling, it is often observed that even so-called wet weather sampling occurs at times when the stream has nearly returned to base-flow conditions.

Due to the extreme drought conditions that existed throughout Clermont County during the 2007 sampling season, Wolfpen Run lacked flow for much of the period, and ambient samples could not be collected on August 28th or October 11th.

Table 1. Weather conditions in 48 hour period prior to time of sampling.

Sample Date	Sample Category	Precipitation @ Hall Run RM 0.2	Precipitation @ Shayler Run RM 1.7
April 26	Wet	0.37	0.49
May 10	Dry	0.00	0.00
May 24	Dry	0.00	0.00
June 6	Wet	0.11	0.07
June 21	Dry	0.02	0.02
July 9	Dry	0.00	0.00
July 26	Dry	0.00	0.00
August 15	Dry	0.00	0.00
August 28	Dry	0.00	0.00
September 12	Wet	0.58	0.17
September 27	Wet	1.04	1.44
October 11	Dry	0.00	0.00

Ambient Stream Sampling Results

Nutrients

Nitrite-nitrate and phosphorus data are presented in Table 2 below:

Table 2. Nutrient concentrations in Hall Run, Shayler Run and Wolfpen Run, May - October, 2007.

Sampling Location/ Parameter	NO_2-NO_3 (mg/L)	Ortho-Phosphate (dissolved) (mg/L)	Total Phosphorus (mg/L)
HALL0.2			
Dry Average (n =8)	0.22	0.05	0.11
Wet Average (n = 4)	0..21	0.05	1.36
Maximum	0.72 (Dry)	0.12 (Wet)	3.88 (Wet)
Minimum	0.02 (Wet)	> 0.02 (Both)	0.03 (Wet)
SHYLR1.7			
Dry Average (n = 8)	0.16	0.05	0.08
Wet Average (n = 4)	0.15	0.09	0.24
Maximum	0.54 (Dry)	0.28 (Wet)	0.79 (Wet)
Minimum	0.08 (Dry)	> 0.02 (Both)	0.03 (Wet)
WLFPN0.1			
Dry Average (n = 6)	0.60	0.17	0.18
Wet Average (n = 4)	0.61	0.16	0.23
Maximum	0.99 (Dry)	0.29 (Dry)	0.42 (Wet)
Minimum	0.29 (Wet)	0.09 (Wet)	0.11 (Dry)

For nutrients, there does not appear to be a significant difference between the wet weather and dry weather data for samples collected in 2007. Average values for all parameters are approximately the same, and for some site/nutrient combinations, the highest values were associated with dry weather. A possible exception is Total Phosphorus in Hall Run and Shayler Run, where average wet weather values are significantly greater than the dry weather averages.

The NO_2-NO_3 concentrations measured in 2007 are relatively low. Even the maximum observed NO_2-NO_3 concentration (0.99 mg/L in Wolfpen Run) is below the Ohio EPA's proposed ambient criteria value of 1.0 mg/L (*Association Between Nutrients, Habitat, and the Aquatic Biota of Ohio Rivers and Streams*, Ohio EPA Technical Bulletin MAS/1999-1-1). The lowest dissolved ortho-phosphate levels were observed in Hall Run (average = 0.05 mg/L for both wet and dry, maximum = 0.12 mg/L). In Shayler Run, values were slightly higher (dry average = 0.05 mg/L, wet average = 0.09 mg/L, maximum = 0.28 mg/L). In both Hall Run and Shayler Run, several samples were below the method detection limit (M.D.L) of 0.02 mg/L. In Wolfpen Run, however, ortho-phosphate levels were considerably higher, averaging 0.17 mg/L in the dry weather samples and 0.16 mg/L in the wet weather samples. None of the Wolfpen Run samples

had values below the M.D.L. The Ohio EPA has not proposed criteria values for ortho-phosphates, so the potential impacts of these higher values is unknown at this time. For Total Phosphorus (TP), the Ohio EPA has proposed an in-stream criteria value of 0.1 mg/L. Historically, a significant number of water samples collected throughout Clermont County over the years have exceeded this threshold. In the 2007 ambient survey, six of the eight dry weather samples from Hall Run had TP values of 0.10 mg/L exactly. The other two samples were below this value. Of the four wet weather samples collected at Hall Run, two had TP values at or above 1.0 mg/L, the highest being 3.88 mg/L on September 27th. By contract, only two of eight of the Shayler Run dry weather samples exceeded 0.1 mg/L, while two of the four wet weather samples had TP values greater than 0.1 mg/L. The remaining five wet weather samples in Shayler Run had TP values below 0.1 mg/L. Unlike Hall Run and Shayler Run, where occasional exceedences were observed, all of the ambient samples collected at Wolfpen Run (dry weather and wet weather) had TP concentrations above the 0.1 mg/L proposed criteria value. The source of nutrient contamination in Wolfpen Run is not known, although possibilities include a package sewage treatment plant serving a mobile home park in the watershed, and a subdivision in the headwaters of the watershed with approximately 200 homes with discharging Home Sewage Treatment Systems (HSTSs). Data from samples taken directly from the mobile home park effluent are presented in another section of this report.

Total Suspended Solids

Total suspended solids (TSS) concentrations were relatively low (> 20.0 mg/L) for all of the dry weather samples, as would be expected. The wet weather samples tended to have higher TSS values at each location, although they remained fairly low (> 50 mg/L) with three exceptions; Hall Run on April 26th (438 mg/L), and Hall Run (4,570 mg/L) and Shayler Run (272 mg/L) on September 27th. On both of these dates, sampling occurred during heavy rain events. Results of ambient TSS sampling are presented in Table 3.

Table 3. Total Suspended Solids (TSS) in Hall Run, Shayler Run, and Wolfpen Run, May - October, 2007.

Sample Site	Average Dry Samples	Average Wet Samples	Minimum	Maximum
HALL0.2	15.10	1,254.54	4.2 (Dry)	4570.00 (Wet)
SHYLR1.7	10.45	72.70	< 1.00 (Both)	272.00(Wet)
WLFPN0.1	4.37	10.95	< 1.00 (Dry)	18.20 (Wet)

All TSS concentrations expressed in milligrams per liter (mg/L).

E. coli

Samples were collected and analyzed for *E. coli* at each site. Ohio EPA water quality standards for Primary Contact state that the *E. coli* geometric mean, based on not less

than five samples collected over a 30-day period, cannot exceed 126 colony forming units (c.f.u.) per 100 mL, and *E. coli* content cannot exceed 298 c.f.u./100 mL in more than 10% of the samples. While the samples collected by the county in 2007 were taken over a longer period of time than the 30-day period in the OEPA standards, a comparison of the county's data to the OEPA criteria is still useful. Results of the county's 2007 ambient *E. coli* sampling are presented in Table 4:

Table 4. *E. coli* concentrations in Hall Run, Shayler Run, and Wolfpen Run, May – October, 2007.

Sample Site	Geo. Mean Dry Samples	Geo. Mean Wet Samples	Minimum	Maximum
HALL0.2	135	2,579	41 (Dry)	24,196 (Wet)
SHYLR1.7	275	334	23 (Wet)	24,196 (Wet)
WLFPN0.1	133	1,905	54 (Dry)	17,329 (Wet)

All E. coli concentrations expressed as colony forming units per 100 milliliters (c.f.u./100 mL).

As expected, the *E. coli* geometric mean was greater during wet weather than dry weather at all three locations. However, even the dry weather geometric mean values for all three sampling locations exceeded the OEPA criteria value of 126 c.f.u./100 mL. In Hall Run, only one of the eight dry weather samples had *E. coli* values greater than 298 c.f.u./100 mL. In Wolfpen Run, only one of six dry weather samples had values greater than 298 c.f.u./100 mL. However, in Shayler Run, 50% of the dry weather samples (4 of 8) exceeded this value.

All three watersheds showed varying degrees of contamination in wet weather sampling. In Hall Run, 75% of the wet weather samples (3 of 4) had *E. coli* concentrations greater than 298 c.f.u./100 mL, while all of the wet weather samples in Wolfpen Run exceeded this value. However, in contrast to the dry weather data, in which Shayler Run had the highest percentage of samples exceeding criteria value (50%), only 25% of Shayler's wet weather samples (1 of 4) exceeded 298 c.f.u./100 mL. The reason for this apparent discrepancy is not known. During the September 27th rainfall event, all three sampling locations had extremely high *E. coli* values (17,329 c.f.u./100 mL at Wolfpen Run, and 24,196 c.f.u./100 mL at both Hall Run and Shayler Run). These data provide evidence of significant fecal contamination in these watersheds in association with high rainfall events. This observation is supported in Hall Run and Shayler Run by the results of wet weather surveys conducted in these watersheds (see below).

Ambient Sampling – Waste Water Treatment Plants

In addition to collecting samples from Hall Run, Shayler Run and Wolfpen Run on a bi-weekly basis, seven semi-public waste water treatment plants (or "package plants") located in the East Fork Little Miami River watershed were sampled periodically throughout the summer. Facilities sampled in this study included the Apple Orchard

Mobile Home Park on SR 28 in Milford (also known as Orchard Lakes Mobile Home Park), which was given the sample designation AOMHP, the Clermont Christian Academy Summer Camp on Lindale – Mt. Holly Road in Monroe Township (sample designation CCA), Clermont Northeast High School on US 50 at Newtonsville – Hutchinson Road (Sample Designation CNE), the Forest Creek Mobile Home Park on Berry Road in Monroe Township (Sample Designation FCMHP), Holly Towne Mobile Home Park on SR 125 in Monroe Township (Sample Designation HTMHP), the Pleasant Hill Mobile Home Park on Wolfpen-Pleasant Hill Road in Miami Township (Sample Designation PHMHP), and the Royal Hill Mobile Home Park on SR 131 in Miami Township (Sample Designation RHMHP). Each site was sampled from four to seven times over the course of the 2007 sampling season, with samples being analyzed for nutrients (NO_2-NO_3, ortho-phosphate, and total phosphorus), total suspended solids (TSS), and *E. coli*. Results of these analyses are presented below.

Nutrients

Average nitrite-nitrate and phosphorus values are presented in Table 5, with the range of values shown in parentheses:

Table 5. Nutrient Concentrations in Package Plant Survey, May – October, 2007

Sampling Location	NO_2-NO_3 (mg/L)	Ortho-P (dissolved) (mg/L)	Total Phosphorus (mg/L)
AOMHP	3.85 (0.82 – 7.43)	1.76 (0.30 – 3.90)	2.53 (0.65 – 5.05)
CCA	44.10 (6.31 – 66.10)	2.75 (< 0.65 – 3.97)	3.48 (0.00 – 9.31)
CNE	0.54 (0.10 – 0.90)	0.05 (0.02 – 0.13)	0.05 (0.02 – 0.08)
FCMHP	30.56 (4.76 – 50.63)	5.77 (2.15 – 8.91)	5.19 (5.14 – 9.07)
HTMHP	23.52 (4.81 – 43.02)	2.96 (1.85 – 3.78)	3.46 (2.96 – 4.22)
PHMHP	22.84 (4.45 – 28.23)	3.03 (0.83 – 4.68)	8.26 (2.63 –29.70)
RHMHP	11.23 (2.19 – 28.41)	2.64 (0.81 – 5.97)	3.54 (1.65 – 6.52)

Other than Clermont Northeast High School, all of the package plants sampled in this survey had extremely high nutrient values, relative to the samples collected in Hall Run, Shayler Run, and Wolfpen Run. Average nutrient values at the Apple Orchard Mobile Home Park were slightly lower to the other locations, but this might be due to the fact that this sample was collected from a culvert that collected effluent from the mobile home park package plant north of Bypass 28 and discharged it into a tributary to Happy Hollow located south of Bypass 28. If sampling occurred after a rain event, the culvert would also be carrying storm water runoff from the area north of the highway, which would dilute the package plant effluent.

Nitrite-Nitrate and Total Phosphorus values in all but the Clermont Northeast High School samples greatly exceeded the Ohio EPA proposed criteria values for these parameters. However, it should be noted that the package plants were sampled at or very near the point of discharge into the streams, and the Ohio EPA criteria values are based on in-stream concentrations outside the mixing zone for a point source discharge, so direct comparisons to these values are not appropriate. Regardless of this fact, it is

apparent from the data that these systems contribute nutrients to their receiving streams and, depending on the discharge rates (volume per unit time), they may be contributing significantly to the overall nutrient loading in these systems. As for Clermont Northeast High School, the only sampling occurred early and late in the sampling season when school was in session. Even so, very low nutrient levels were present in these samples.

Total Suspended Solids

Total Suspended Solids (TSS) values for the package plant survey are presented in Table 6 below:

Table 6. Total Suspended Solids (TSS) in Package Plant Survey, May - October, 2007.

Sample Site	Average	Minimum	Maximum
AOMHP	29.55	1.10	117.00
CCA	130.88	<1.00	519.00
CNE	15.79	6.75	33.80
FCMHP	2.88	<1.00	10.00
HTMHP	1.04	<1.00	1.25
PHMHP	559.70	2.00	3340.00
RHMHP	1.65	<1.00	3.50

All TSS concentrations expressed in milligrams per liter (mg/L).

Overall, the package plant effluents had Total Suspended Solids concentrations similar to the values observed in Hall Run, Shayler Run and Wolfpen Run. Average values for several locations were somewhat skewed by extremely high TSS values associated with the heavy rains during the September 27th sampling event. Two of the package plants (Forest Creek Mobile Home Park and Holly Towne Mobile Home Park) had Total Suspended Solids values consistently near or below the method detection limit of 1.00 mg/L.

E. coli

Geometric mean *E. coli* values for the package plant survey are presented in Table 7.

Table 7. *E. coli* concentrations in Package Plant Survey, May – October, 2007.

Sample Site	Geo. Mean	Minimum	Maximum
AOMHP	383	15	> 8,000
CCA	98	7.7	1,400
CNE	2,196	610	7,887
FCMHP	7	< 4	10
HTMHP	25	< 7.7	495
PHMHP	7,481	1,200	24,196
RHMHP	21	< 7.7	121

All E. coli concentrations expressed as colony forming units per 100 milliliters (c.f.u./100 mL).

Unlike the nutrient and suspended solids data, the *E. coli* values showed a high degree of variability between the sites. Three of the seven sites had geometric mean values greater than the OEPA criteria value of 126 c.f.u./100 mL, with Clermont Northeast High School the Pleasant Hill Mobile Home Park greatly exceeding this threshold. All samples collected at these two locations exceeded criteria limits. At the Apple Orchard Mobile Home Park, three of the six samples had extremely high values, with two samples exceeding 8,000 c.f.u./100 mL,. The remaining three sites had very low *E. coli* concentrations, with several sampled not exceeding the method detection limit. One possible explanation for this discrepancy would be the extent to which each of these facilities uses chlorine or some other disinfectant in their treatment process. For many of the plants with discharge permits, a review of OEPA data reveals that most plants do not have problems meeting their bacteria limits but often exceed their chlorine discharge limits due to excessive addition of chlorine to disinfect their waste stream.

Dry Weather Surveys

As stated in the introduction, the county performed a series of dry weather studies during the summer of 2007 in an effort to identify potential illicit discharges in the Newtonsville and Horner Run areas of the county. The Newtonsville area has been sampled as part of the county's ambient monitoring program in prior years, and was shown to have poor water quality. This year's study was designed to focus in on potential sources of water quality impairment in the Newtonsville area, to determine if there were areas of impairment in the Horner Run watershed, and to identify potential sources of these impairments.

Sampling Locations

Grab samples were collected from nine sites in the Newtonsville area, three on the main stem of Newtonsville Creek, three on tributaries to the main stem, and three from storm water outfalls. Nine sites were sampled in the Horner Run watershed, three on the main stem of Horner Run and six on tributaries to the main stem. Maps of these sampling locations are presented in Figure 1 (Newtonsville) and Figure 2 (Horner Run) below:

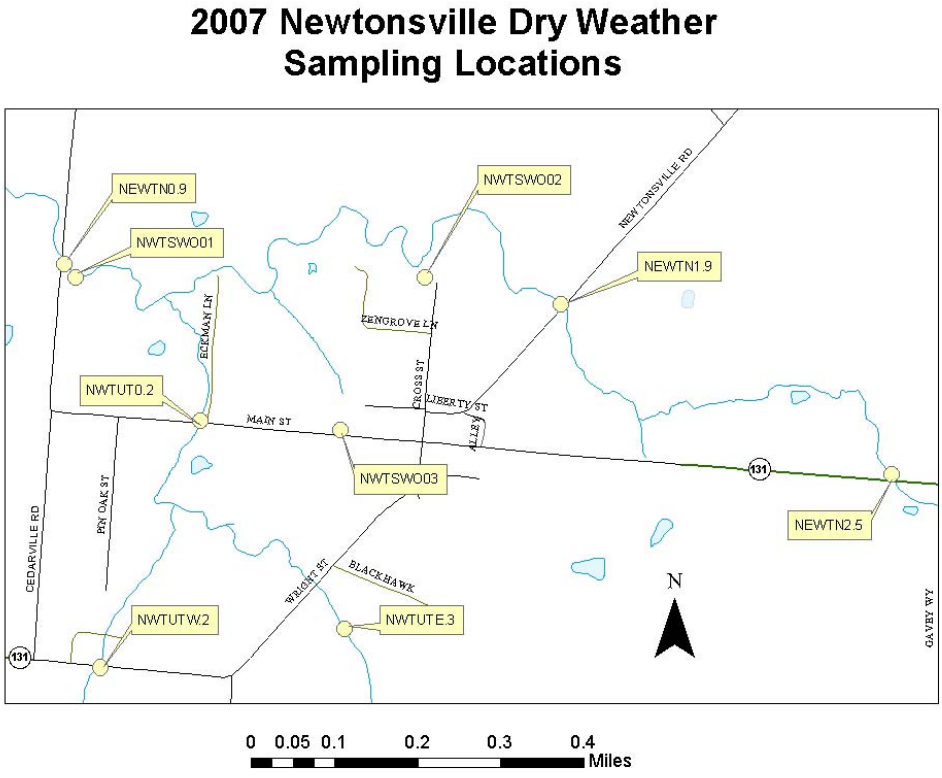


Figure 1. 2007 Dry Weather Survey - Newtonsville Sampling Locations.

The Newtonsville sampling focused on a section of the Newtonsville Creek watershed in the vicinity of the village of Newtonsville. The first sample (NEWTN2.5) is upstream of the village where the stream flows under SR 131. The designation comes from the fact

that this location is 2.5 miles upstream of the confluence of Newtonsville Creek with Stonelick Creek. The next site (NEWTN1.9) is located where the stream passes under Newtonsville Road, and is 1.9 miles upstream of the confluence with Stonelick Creek. Moving downstream from here, the next site is identified as NWTSWO02. This is a storm water outfall at the end of Cross Street that is connected to the stream via an open channel approximately 100 meters in length. The site identified as NWTSWO03 is another storm water outfall sampled immediately north of Main Street. It is connected to the main stem of Newtonsville Creek by an open channel approximately 335 meters in length. Downstream from here, we find sampling locations identified as NWTSWO01, a storm water outfall entering the stream just upstream of Cedarville Road, and NEWTN0.9, an in-stream sample taken just upstream of the Cedarville Road bridge 0.9 miles upstream of the confluence with Stonelick Creek. Three additional sites are located on un-named tributaries to Newtonsville Creek. One of these sites (NWTUT0.2) is located 0.2 miles upstream of the confluence of the tributary with Newtonsville Creek, where the tributary passes under Main Street. The other two sites (NWTUTE.3 and NWTUTW.2) are located on an eastern branch of the tributary 0.3 miles upstream of the point where the tributary forks, and on a western branch 0.2 miles upstream of the fork, respectively. Both of these sites are accessed from Wright Street.

The Horner Run sampling focused on three clusters, the first of which was located at the confluence of tributaries off Wood Ridge Drive. The branch of the stream entering the confluence from the north (WDRGUSN) drains a street served by on-site systems, and has been the source of odor complaints in the recent past. The stream entering the confluence from the south (WDRGUSS) drains an area of homes served by a centralized sewer system. A sample was also collected downstream of the confluence (WDRGDS). The second set of samples was collected near a lift station on a tributary to Horner Run at the Cook Road bridge, in order to determine if the lift station might be contributing to any contamination observed in the watershed. Samples were collected from the tributary above (COOKUS) and below (COOKDS) the lift station, and also from the main stem of Horner Run just below the confluence of the tributary (HORNR2.1). The final cluster of sites is further downstream in a tributary named Bucklick Run (BKLCK0.1), which collects water from the un-named tributary off Wood Ridge Drive and several other streams, and the mainstem of Horner Run just upstream (HORNR0.9) and downstream (HORNR0.8) of the Bucklick Run confluence.

Dry weather surveys were conducted in Newtonsville on July 24 and August 14. Dry weather surveys were performed in Horner Run on June 14, August 1, and August 5.

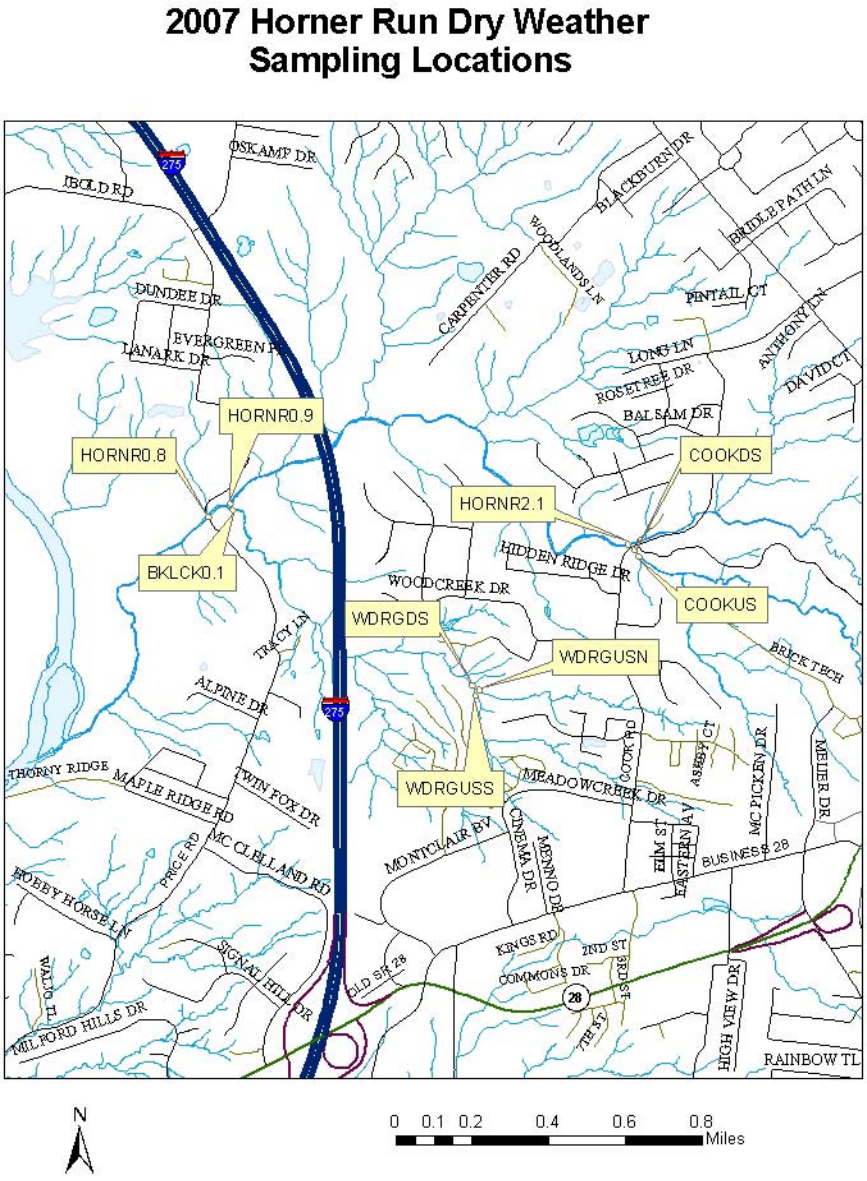


Figure 2. 2007 Dry Weather Survey – Horner Run Sampling Locations.

Dry Weather Survey Results

Newtonsville Area

Results of the dry weather surveys conducted in the Newtonsville area are presented in Table 5 and Table 6 below:

Table 5. Nutrient Results from 2007 Newtonsville Dry Weather Surveys.

Sampling Site	NO_2-NO_3	Ortho-P	TP
NEWTN2.5*	0.00	0.22	1.54
NEWTN1.9	0.16 (0.10 – 0.22)	0.48 (0.36 – 0.59)	0.95 (0.74 – 1.15)
NWTSWO02*	0.23	**	0.34
NWTSWO03	0. 10 (0.00 – 0.20)	3.89 (3.27 – 4.50)	6.03 (4.34 – 7.72)
NWTSWO01	0.33 (0.04 – 0.62)	0.11 (0.04 – 0.19)	0.51 (0.01 – 1.01)
NEWTN0.9	0.6 (0.00 – 0.11)	0.23 (0.14 – 0.31)	0.32 (0.32 – 0.33)
NWTUT0.2	1.22 (0.10 – 2.33)	2.11 (1.49 – 2.72)	2.00 (1.59 – 2.42)
NWTUTE.3	0.05 (0.00 – 0.10)	0.08 (0.01 – 0.15)	0.09 (0.04 – 0.14)
NWTUTW.2	0.32 (0.10 – 0.53)	1.43 (0.15 – 2.72)	1.02 (0.45 – 1.59)

Results presented as average, with range in parentheses. All units are mg/L.

** August 14 sampling – very low flow. Unable to collect NEWTN2.5 or NWTSWO02 sample.*
*** Unable to analyze sample for Orthophosphate or TSS.*

Table 6. Other Results from 2007 Newtonsville Dry Weather Surveys.

Sampling Site	TSS	*E. coli*
NEWTN2.5*	42.7	66
NEWTN1.9	17.0 (14.0 – 20.0)	36 (10 – 131)
NWTSWO02*	**	1,355
NWTSWO03	42.0 (18.0 – 66.0)	53,958 (12,033 – 241,958)
NWTSWO01	371.5 (4.0 – 739.0)	1,045 (20 – 54,620)
NEWTN0.9	174.35 (11.7 – 337.0)	1,442 (85 – 24,477)
NWTUT0.2	21.84 (9.7 – 34.0)	23,398 (3,873 – 141,360)
NWTUTE.3	17.0 (10.8 – 23.2)	4 (0 – 20)
NWTUTW.2	77.3 (9.7 – 145.0)	1,925 (957 – 3,873)

TSS results presented as average, with range in parentheses. TSS units are mg/L.
E. coli results presented as geometric means, with range in parentheses. E. coli units are c.f.u./100 mL

** August 14 sampling – very low flow. Unable to collect NEWTN2.5 or NWTSWO02 sample.*
*** Unable to analyze sample for Orthophosphate or TSS.*

NO_2-NO_3 concentrations were relatively low, with only one sample out of sixteen (NWTUT0.2, the downstream sample on the un-named tributary) having a NO_2-NO_3 concentration exceeding the proposed criteria value of 1.0 mg/L in the August 14th sample. The ortho-phosphorus and total phosphorus data present a somewhat different picture. Only two of the sixteen samples measured for Total Phosphorus had concentrations below the proposed criteria value of 0.1 mg/L, and many samples greatly exceeded this value, especially the storm water outfall located on Main Street in the center of the village (NWTSWO03), with values of 4.34 and 7.72 mg/L.

There are no existing or proposed criteria values for Total Suspended Solids and, as often observed under low flow conditions, suspended sediment values were generally low compared to concentrations typically observed following rain events.

Ohio EPA criteria states that the *E. coli* geometric mean, based on not less than five samples collected over a 30-day period, cannot exceed 126 colony forming units (c.f.u.) per 100 mL, and *E. coli* content cannot exceed 298 c.f.u./100 mL in more than 10% of the samples. Since the dry weather surveys only involved two sampling events, results of the survey cannot be compared to these criteria values from a regulatory perspective, but the criteria values can still serve as a useful benchmark, and are used in this capacity in this report. As shown in Table 6, several sites greatly exceed a geometric mean of 126 c.f.u./100 mL, and two of the locations (NWTSWO03 and NWTUT0.2) have extremely high geometric mean *E. coli* values (53,958 c.f.u./100 mL and 23,398 c.f.u./100 mL respectively), primarily as a result of exceedingly high values (> 100,000 c.f.u./100 mL) associated with the August 14 sampling event. With low upstream contamination (NEWTN2.5 and NEWTN1.9 had geometric mean values below 100 c.f.u./100 mL) and a high geometric mean value of 1,442 c.f.u./100 mL at the downstream sampling location (NEWTN0.9), there is strong evidence that high *E. coli* concentrations in the main stem are likely due to runoff from these storm water outfalls, the general influence of failing on-site home sewage treatment systems (HSTSs), or the presence on farm animals in the area immediately around the village. One interesting observation is the high *E. coli* value at NWTUT0.2, the un-named tributary sampled at Main Street (geometric mean = 23,398 c.f.u./100 mL), and relatively high concentration (1,925 c.f.u./100 mL) in the western upstream branch of the tributary (NWTUTW.2). The eastern upstream tributary sample (NWTUTE.3) was clean, with a geometric mean value of only 4 c.f.u./100 mL. There is very little development of any kind in this part of the watershed, but the "spike" in contaminants observed at NWTUT0.2 and NWTUTE.3 may be due to the influence of an undetected outfall in the area. This may warrant further investigation.

In general, the high nutrient and fecal contaminant concentrations observed in many of the samples collected within the Village of Newtonsville support earlier speculation that on-site HSTSs are not providing adequate treatment and are allowing partially treated sewage to enter the Newtonsville Creek watershed. Of particular concern is the fact that these outfalls are connected to the stream via open channels that flow through the village and are easily accessible by the residents of the village and their pets. With fecal contaminant concentrations orders of magnitude greater than state Primary Contact standards, this poses a significant risk of illness to residents of the village. The County is currently investigating options that would minimize or eliminate this risk. Options currently being considered include connection of the village to centralized sewers serviced by an existing wastewater treatment plant, or construction of a package treatment plant near the village. Input from the village and its residents will be an integral part of the decision-making process as the county moves forward in these efforts.

Horner Run

Results of sampling performed in the Horner Run watershed are presented in Table 7 and Table 8 below:

Table 7. Nutrient Results from 2007 Horner Run Dry Weather Surveys.

Sampling Site	NO_2-NO_3	Ortho-P	TP
WDRGUSN	0.42 (0.10 – 0.86)	0.10 (0.09 – 0.11)	0.12 (0.08 – 0.17)
WDRGUSS	0.24 (0.10 – 0.40)	0.08 (0.07 – 0.09)	0.11 (0.08 – 0.17)
WDRGDS	0.26 (0.10 – 0.40)	0.08 (0.07 – 0.08)	0.08 (0.07 – 0.09)
COOKUS	0.82 (0.18 – 1.92)	0.09 (0.08 – 0.09)	0.11 (0.10 – 0.12)
COOKDS	0.75 (0.10 – 1.84)	0.07 (0.06 – 0.08)	0.08 (0.06 – 0.11)
HORNR2.1	0.69 (0.10 – 1.82)	0.08 (0.07 – 0.08)	0.09 (0.07 – 0.11)
BKLCK0.1	0.36 (0.10 – 0.61)	0.06 (0.05 – 0.07)	0.05 (0.03 – 0.08)
HORNR0.9	1.82 (0.75 – 3.95)	0.11 (0.08 – 0.14)	0.11 (0.08 – 0.15)
HORNR0.8	0.93 (0.55 – 1.68)	0.10 (0.08 – 0.12)	0.10 (0.08 – 0.13)

Results presented as average, with range in parentheses. All units are mg/L.

Table 8. Other Results from 2007 Horner Run Dry Weather Surveys.

Sampling Site	TSS	*E. coli*
WDRGUSN	41.8 (7.8 – 84.4)	151 (77 – 255)
WDRGUSS	32.1 (20.6 – 42.4)	493 (195 – 1,500)
WDRGDS	6.6 (5.8 – 7.8)	107 (12 – 644)
COOKUS	35.2 (9.8 – 76.0)	117 (90 – 160)
COOKDS	3.4 (2.2 – 5.3)	237 (208 – 260)
HORNR2.1	4.5 (2.6 – 6.9)	72 (8 – 270)
BKLCK0.1	2.7 (2.0 – 3.1)	111 (62 – 293)
HORNR0.9	2.0 (1.6 – 2.4)	99 (62 – 208)
HORNR0.8	6.3 (1.0 – 14.8)	137 (92 – 190)

TSS results presented as average, with range in parentheses. TSS units are mg/L.
E. coli results presented as geometric means, with range in parentheses. E. coli units are c.f.u./100 mL

In the Horner Run survey area, average NO_2-NO_3 values exceeded the proposed OEPA criteria value of 1.0 mg/L at only one location, HORNR0.9, just upstream of the confluence of Bucklick Creek. Two of the three samples collected at this location had values below the criteria value, while the September 5 sample had a concentration of 3.95 mg/L, driving the average over the proposed limit. Five of the nine sites had average Total Phosphorus values above the proposed criteria value of 0.1 mg/L, but no single sample value exceeded 0.2 mg/L. It is interesting to note that, while phosphorus exceedences seemed to be more of an issue in Newtonsville, nitrogen seemed to be more of a problem in Horner Run although, overall, nutrients do not seem to be a significant problem in this watershed.

As noted in the Newtonsville study, Total Suspended Solids (TSS) values were low relative to historic values observed after rain events, as anticipated. Unlike the Newtonsville study, geometric mean *E. coli* values were at or near the proposed OEPA criteria values for all sites. One site (WDRGUSS) did have two samples with measurements exceeding 298 c.f.u./100 mL (410 c.f.u./100 mL on June 14 and 1,500 c.f.u./100 mL on September 5). It is not clear why this site would have elevated *E. coli* levels, as this drainage area is believed to be served by centralized sewers and no problems have been reported with the sewers in this area. There is no agricultural activity in the watershed.

In summary, nutrient concentrations do not appear to be a systemic problem in the Horner Run watershed, and there does not appear to be a significant loading of bacteria into the stream, either from the un-sewered homes in the area around Woo Ridge Drive or from the Cook Road lift station. The two high *E. coli* values observed in the southern branch of the unknown tributary near Wood Ridge Drive may warrant further investigation.

Wet Weather Surveys

Rainfall and stream level data for the four wet weather sampling events conducted at the Hall Run and Shayler Run autosampler stations are presented in Figures 3-6. Results of the wet weather surveys are presented in Table 9 and Table 10, respectively.

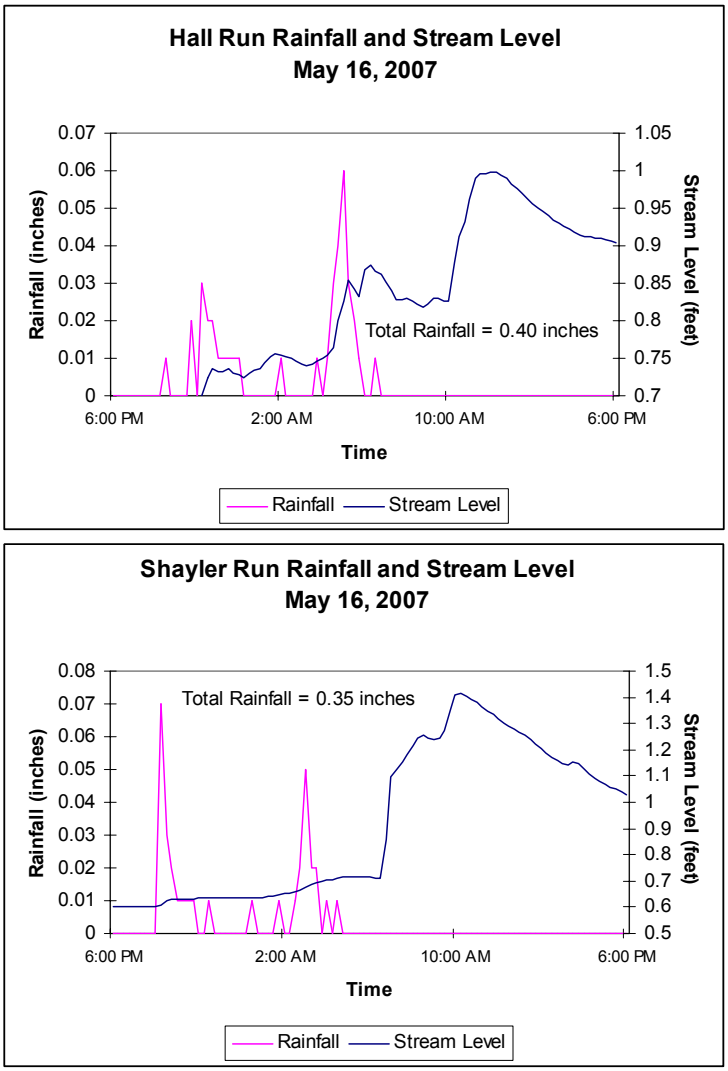


Figure 3. May 16, 2007 Wet Weather Sampling Event.

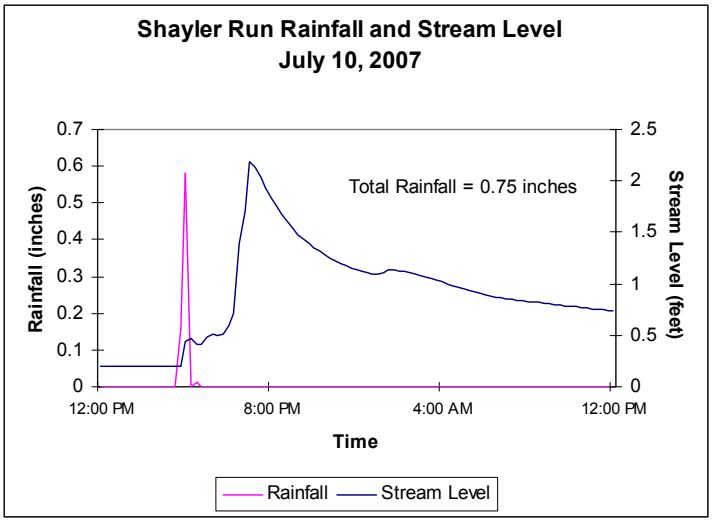
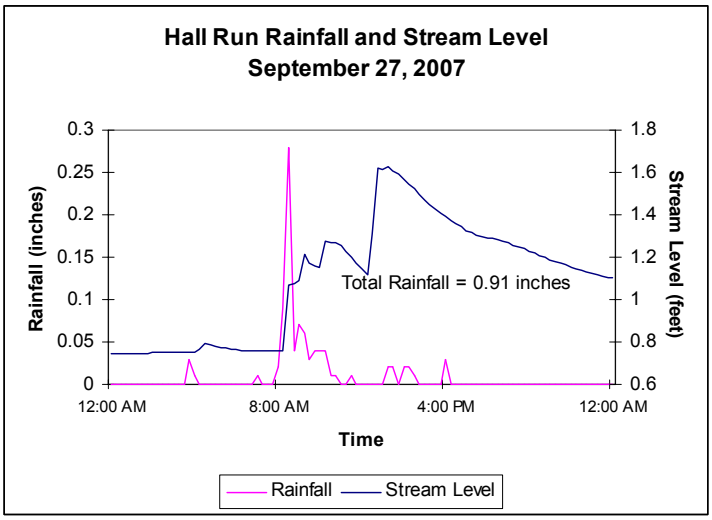


Figure 4. July 10, 2007 Wet Weather Sampling Event.



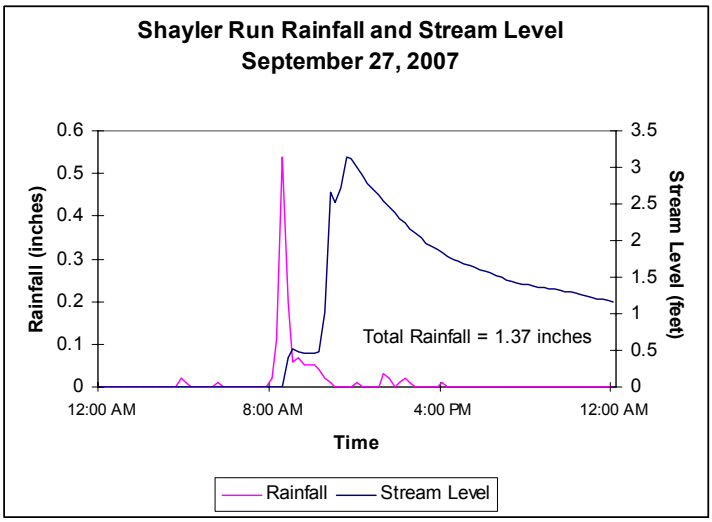


Figure 5. September 27, 2007 Wet Weather Sampling Event.

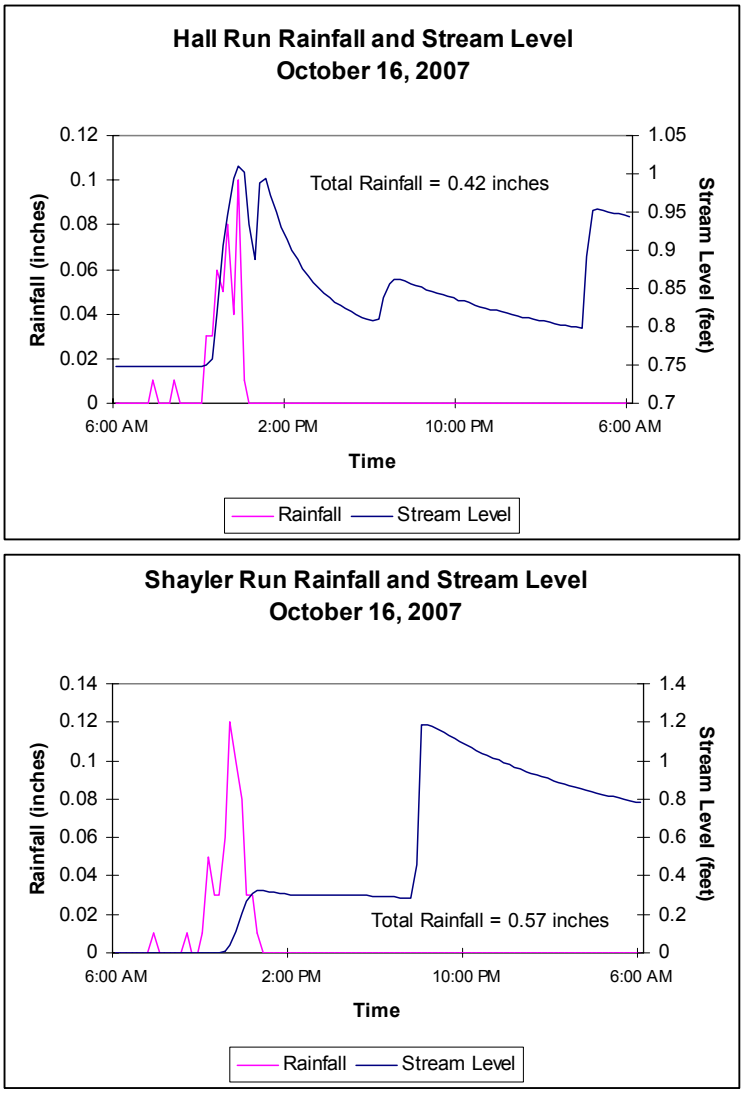


Figure 6. October 16, 2007 Wet Weather Sampling Event.

Table 9. Hall Run Wet Weather Sampling Results, May - October, 2007.

May 16, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Peak/Level	0.84	0.03	0.02	62.6	1,100
Falling	0.96	0.02	0.10	15.8	850

September 27, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Rising	0.25	0.13	9.40	6,740.0	17,392
Falling	0.73	0.10	2.46	1,640.0	19,863

October 16, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Rising	0.46	0.09	9.84	4,780.0	8,664
Peak/Level	0.27	0.03	2.70	1,620.0	7,270
Falling	0.22	0.04	1.32	683.0	7,701

All measurements in mg/L except E. coli, which is reported in c.f.u./100 mL.

Table 10. Shayler Run Wet Weather Sampling Results, May - October, 2007.

May 16, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Rising	0.21	0.01	0.18	64.8	810
Peak/Level	0.56	0.01	0.12	25.2	580
Falling	0.51	0.01	0.09	14.0	2,600

July 10, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Rising	0.47	0.01	1.18	709.0	14,136
Peak/Level	1.00	0.01	0.93	598.0	19,863
Falling	0.79	0.02	0.52	242.0	8,664

September 27, 2007

Stream Stage	NO_3-NO_2	Ortho-P	TP	TSS	*E. coli*
Rising	0.44	0.26	2.33	1,090.0	15,531
Peak/Level	0.80	0.09	2.04	1,340.0	17,329
Falling	0.79	0.08	1.03	532.0	24,196

October 16, 2007

Stream Stage	NO_2-NO_3	Ortho-P	TP	TSS	*E. coli*
Rising	0.24	0.04	0.40	218.0	12,997
Peak/Level	0.76	0.09	0.51	256.0	15,531
Falling	0.52	0.05	0.32	124.0	12,033

All measurements in mg/L except E. coli, which is reported in c.f.u./100 mL.

By the time the autosampler at Hall Run triggered on May 16, hydrographic data indicated that the stream was already at peak height for the event. Therefore, no "Rising" sample was collected. Also, the Hall Run autosampler did not trigger during the July 10 event, and malfunctioned during the September 27 event, collecting the first and last set of samples but nothing in between. As a result, there is no "Peak/Level" sample for this event. The malfunction observed on September 27 was probably due to clogging of the intake, which was found to be embedded under several inches of muck. The intake was cleaned, and the autosampler preformed satisfactorily during the October 16 sampling event. No problems were experienced with the Shayler Run autosampler during any of the four sampling events in 2007.

Only one nitrite-nitrate value (Shayler Run Peak/Level on July 10) equaled the proposed criteria value of 1.0 mg/L, with all other values below this benchmark. However, all but one total phosphorus levels in the wet weather surveys exceeded the proposed criteria value of 0.1 mg/L, and extremely high values were observed during some storm events, especially when high levels of suspended solids were also reported. This correlation is not surprising, given that phosphorus is known to absorb to soils and other particulate matter. Finally, three of the four wet weather events (July 10, September 27 and October 16) had extremely high *E. coli* values in all of the samples. Such evidence of fecal contamination has also been seen in both ambient and wet weather surveys in previous years. Figure 3 shows a map of the Hall Run watershed with the location of discharging and non-discharging home sewage treatment systems (HSTSs). Note the high concentration of discharging systems in the Pepper Ridge subdivision, located on a tributary to Hall Run just upstream of the sampling site. If the HSTSs in this area are not fully treating the waste they receive, this could be a potential source of the high *E. coli* values observed in this study. Clermont County also has a sewer line running parallel to Hall Run, and any leaks or accidental discharges from this line would also lead to elevated *E. coli* concentrations in the stream. A 5-million gallon equalization basin has been installed in the headwaters of Hall Run and should help to mitigate any impacts from this system.

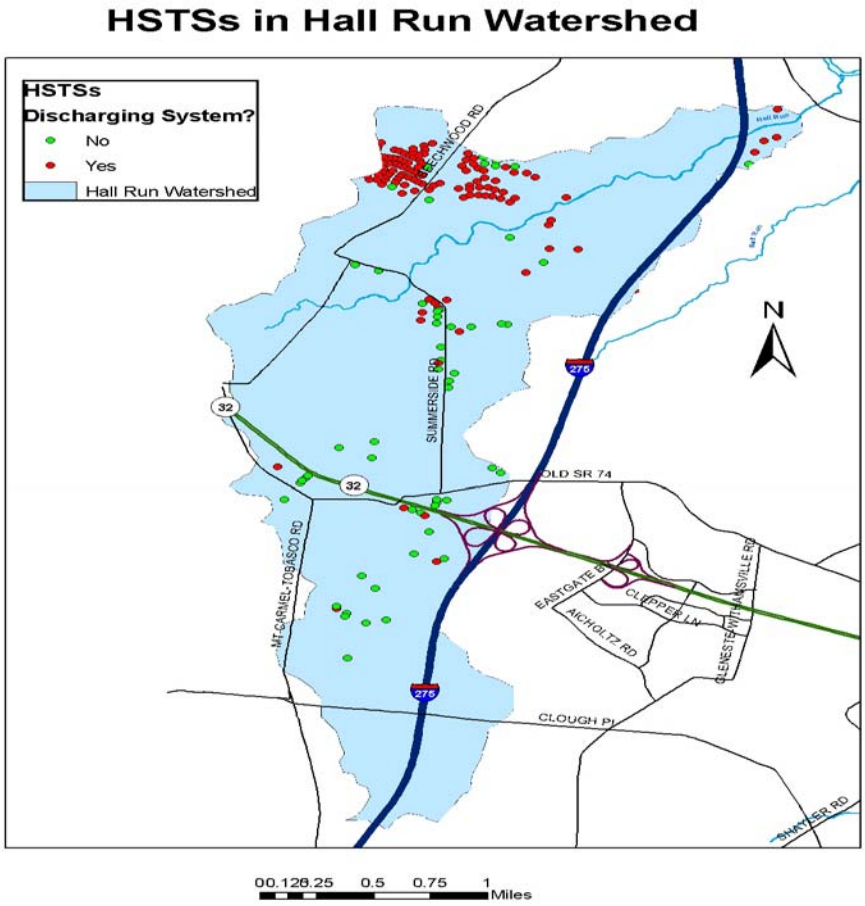


Figure 3. Hall Run Watershed showing location of Home Sewage Treatment Systems

Results for the Shayler Run wet weather surveys are similar to those in Hall Run, in that the nitrite-nitrate and ortho-phosphorus levels are not significantly different from those observed in the ambient samples. Total phosphorus and total suspended solids values showed a correlation similar to that observed in the Hall Run data, although concentrations of both parameters were lower overall in Shayler Run. *E. coli* concentrations, on the other hand, were as high, or higher than those observed in Hall Run, with four of the five Shayler Run surveys producing at least one *E. coli* value greater than 8000 c.f.u./100 mL. From an analysis of Figure 4, there are no obvious concentrations of discharging HSTSs in Shayler Run, as there are in Hall Run. Other potential sources for fecal contamination in the stream include the sewer line running parallel to the stream. This has caused problems in the past due to overflow associated with storm water infiltration, and the county is in the process of replacing the sewer line and has installed a 5-million gallon equalization basin to avoid future problems. Another potential source of fecal contamination in the watershed would be from animals, either wild or domestic. While there are no large cattle farming operations in the area, there are a number of horse farms that may be contributing to the problem through improper management of manure. Due to the fact that the watershed is highly residential, pet waste may also contribute to the observed contamination.

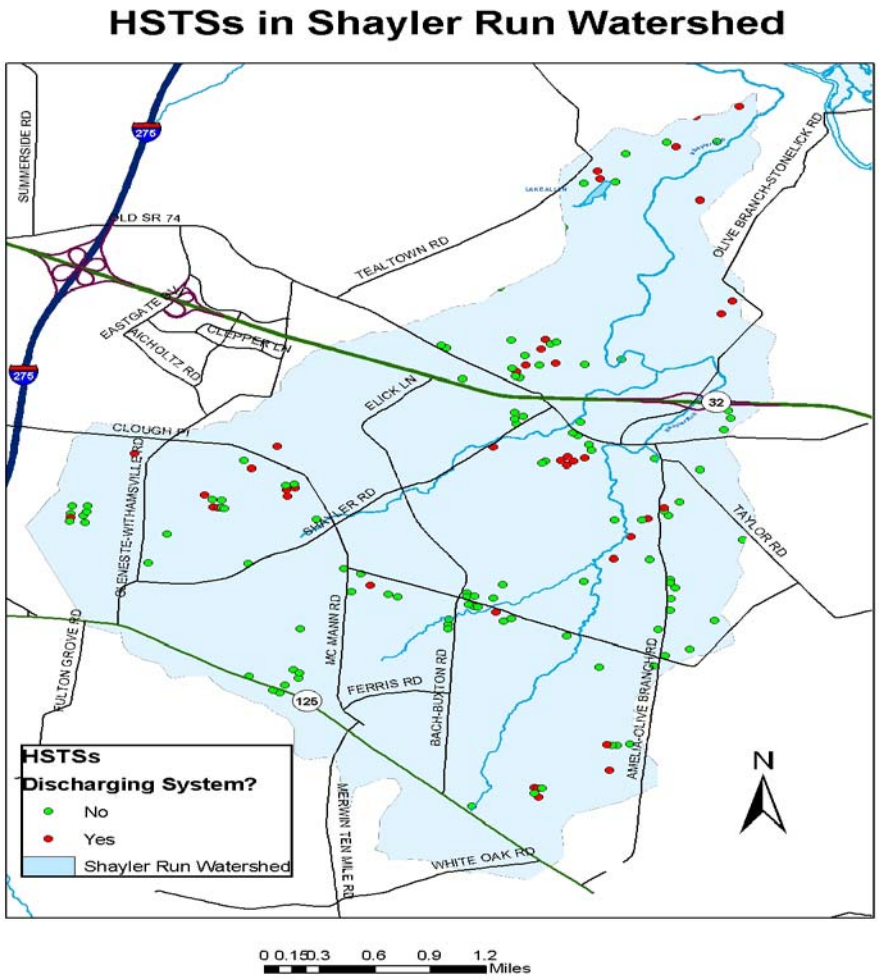


Figure 4. Shayler Run Watershed showing location of Home Sewage Treatment Systems

Diurnal Dissolved Oxygen Profiles

In 2007, Clermont County Office of Environmental Quality (OEQ) conducted its first set of 24-hour dissolved oxygen (DO) profiles at five locations on the mainstem of the East Fork Little Miami River and at one location on Wolfpen Run. The profiles are designed to document the impacts of nutrients or organic enrichment on dissolved oxygen levels. Nutrients promote algal growth. High nutrient levels can lead to the formation of large algal blooms and mats that clog the streams. Once the algae die, they are degraded by bacteria in the water column in a process that strips oxygen from the water. Low dissolved oxygen levels can stress or kill fish and other organisms, resulting in impairment of these waterbodies. Similarly, the introduction of biodegradable organic materials into the streams (organic enrichment) can have a similar effect, as the bacteria responsible for this biodegradation consume oxygen in the process. Dissolved Oxygen

levels are monitored over an entire 24-hour period in order to account for the natural diurnal changes that occur in DO levels in aquatic ecosystems. Also, the profiles are performed during summer low-flow conditions in order to measure maximum impacts.

Clermont County OEQ originally proposed to conduct three 24-hour DO profiles at the Wolfpen Run RM0.1 sampling location, in partial fulfillment of the requirements of a 319 grant from the Ohio EPA to the Clermont County Soil and Water Conservation District. However, due to the extreme drought conditions that existed in the area for most of the sampling season. Only one complete profile was collected. The stream was dry for a significant part of the season and, when rainfall events did occur, the stream quickly rose and fell, seldom remaining under low-flow conditions for a 24-hour period. Results of the successful profile are presented in Figure 5:

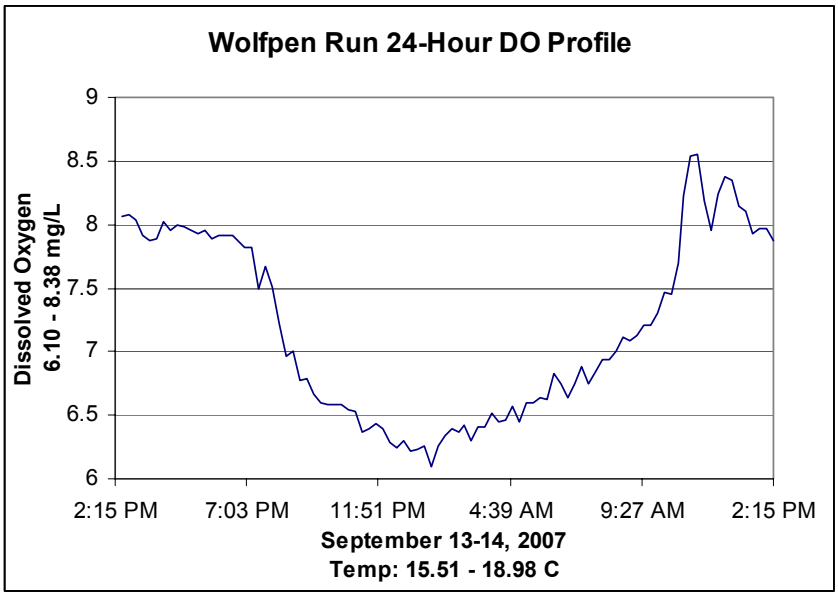


Figure 5. Wolfpen Run 24-Hour DO Profile.

Throughout the 24-hour period, dissolved oxygen concentrations remained well in excess of the minimum in-stream criteria value for Warmwater Habitats, which is 4.0 mg/L. In the East Fork mainstem, DO profiles were collected above and below the Batavia, Middle East Fork (MEF), and Lower East Fork (LEF) wastewater treatment plants (WWTPs). The profile collected above the Middle East Fork WWTP also served as the profile below the Batavia WWTP, as these two plants have their effluents in close proximity to one another (Batavia at RM 13.59 and MEF at RM 12.59). Wastewater treatment plants can be sources of nutrients and organic enrichment via their effluent, and impacts are manifested as DO "sags" or drops in DO concentrations downstream of a pollution source. According to Ohio EPA's water quality standards for dissolved oxygen, average DO levels in Exceptional Warmwater Habitats should not fall below 6.0 mg/L, and individual measurements should never fall below 5.0 mg/L. Results of the profiles collected in the East Fork mainstem in 2007 are shown in Figures 6-10.

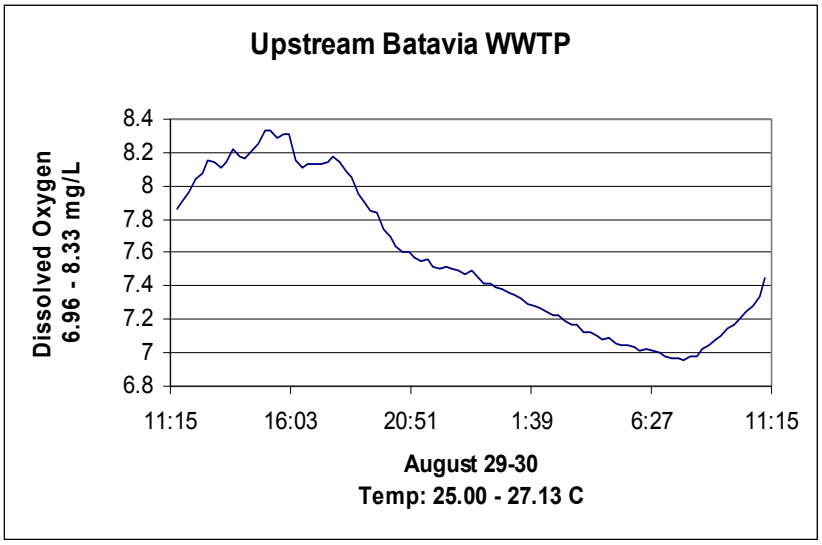


Figure 6. 24-Hour DO Profile above Batavia WWTP.

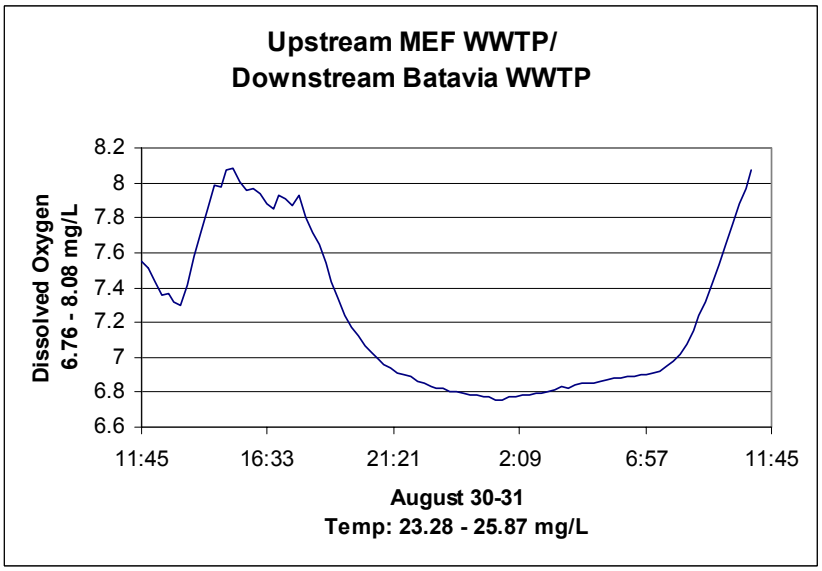


Figure 7. 24-Hour DO Profile above Middle East Fork WWTP.

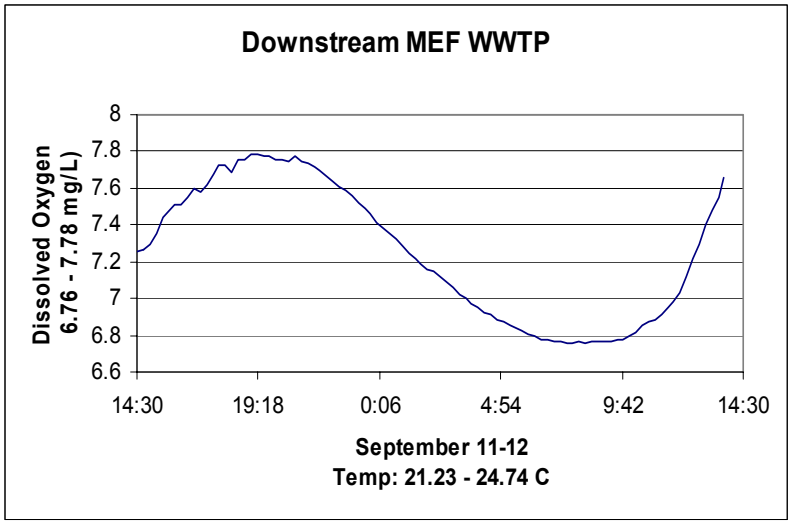


Figure 8. 24-Hour DO Profile below MEF WWTP.

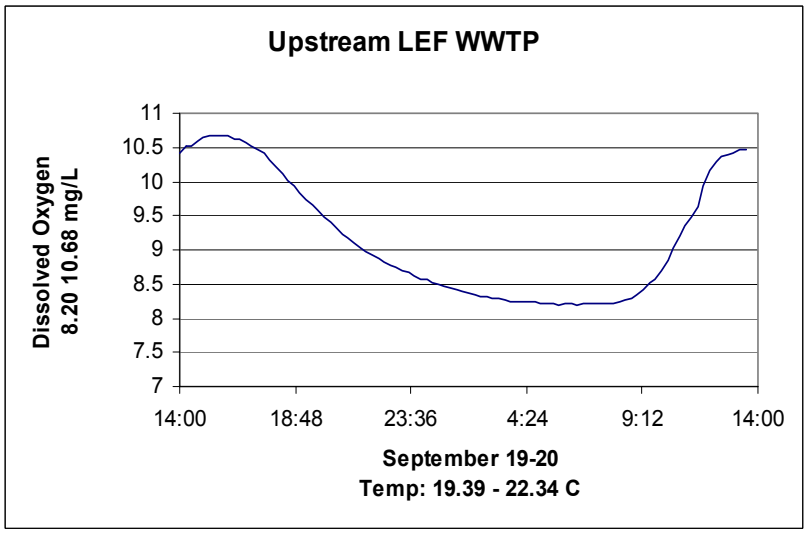


Figure 9. 24-Hour DO Profile above LEF WWTP.

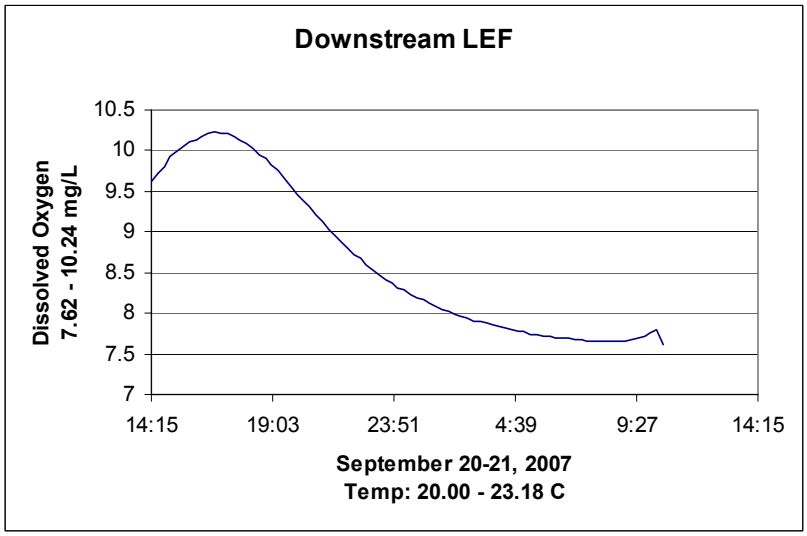


Figure 10. 24-Hour DO Profile below LEF WWTP.

Due to equipment problems, only one data sonde was available for collecting DO profiles for most of the sampling period. As a result, profiles above and below each point source were not taken on the same day, and changes in water temperature between sampling events caused changes in the saturability of oxygen. Therefore, when looking at DO expressed as concentration (i.e. mg/L), it is difficult to ascertain whether or not nutrients or organic enrichment from the WWTPs are causing sags in DO within the East Fork. If the data are plotted as percent saturation instead of concentration and the events around the Batavia and MEF plants are overlaid (Figure 11), there does appear to be a slight drop in dissolved oxygen below the treatment plants.

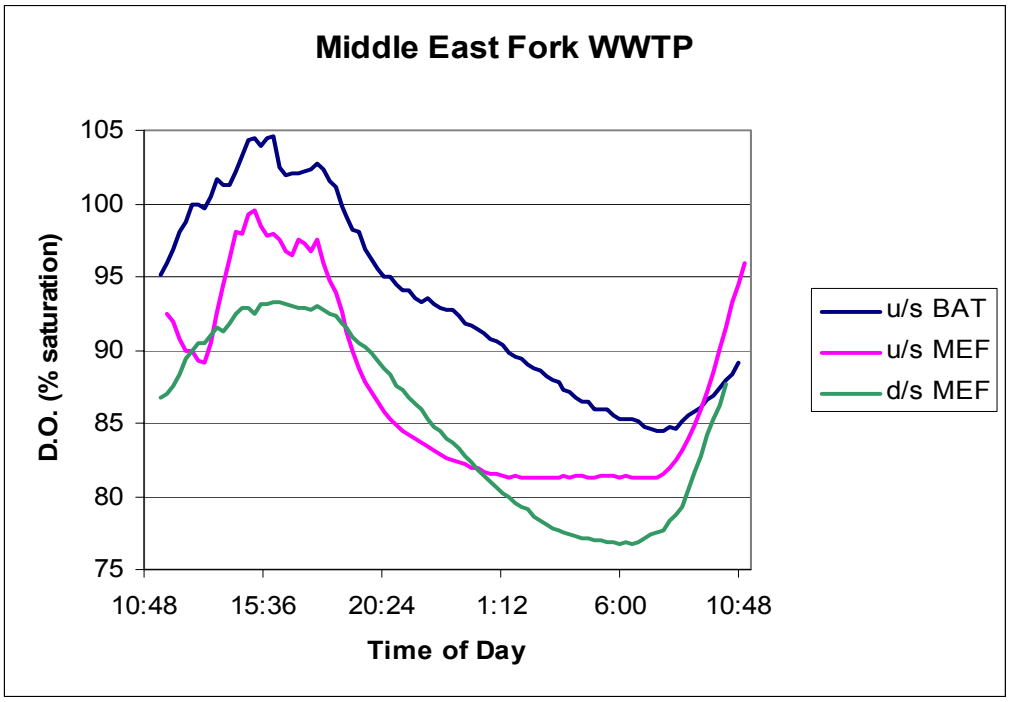


Figure 11. 24-Hour DO Profiles around the Batavia and MEF WWTPs.

It was possible to collect DO profiles above and below the LEF concurrently once during the 2007 sampling season (Figure 11). During this event, there does not appear to be any decrease in DO levels as a result of the LEF WWTP effluent.

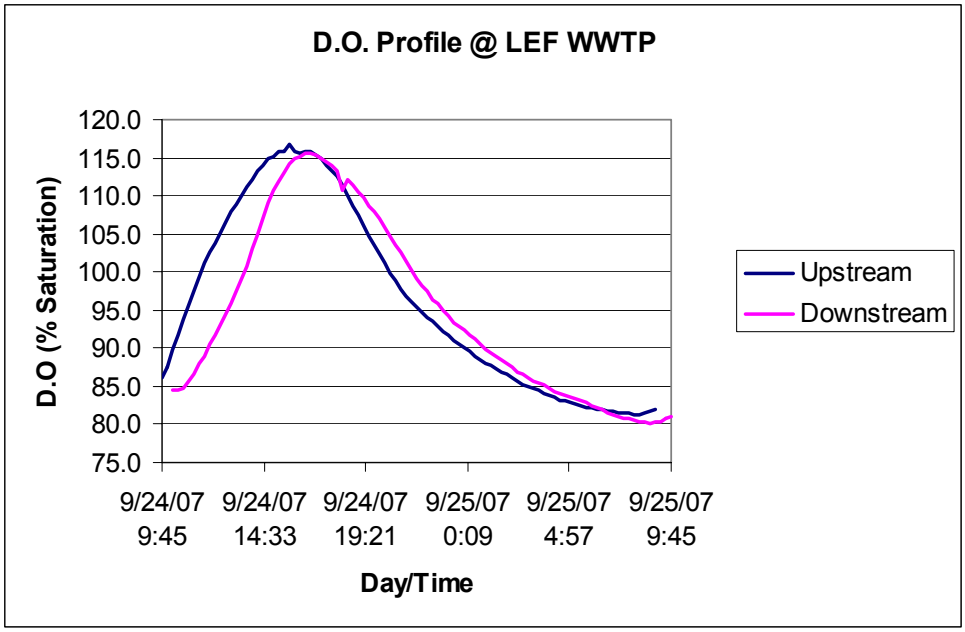


Figure 11. 24-Hour DO Profile above and below LEF WWTP.

It is obvious from an examination of the data in Figures 5-11 that any impacts of wastewater treatment plants on dissolved oxygen levels in the lower East Fork Little Miami River are minimal, and all locations greatly exceeded state water quality standards for dissolved oxygen.

Conclusions/Recommendations

- Work with OEPA and Clermont County General Health District to address semi-public WWTPs throughout the East Fork watershed.
- Work with OEPA and the General Health District to address the semi-public WWTP and subdivision with discharging HSTSs in the Wolfpen Run watershed, and continue to monitor the stream for improvements in water quality as these problems are addressed.
- Work with Village of Newtonsville to eliminate contamination of Newtonsville Creek through centralized sewers or installation of a package treatment plant.
- Investigate Pepper Ridge as potential source of Hall Run fecal contamination.
- Source identification of Shayler Run *E. coli* (human vs. animal).
- Continue to monitor Shayler Run to document improvements in WQ associated with sewer upgrades.
- Monitor the CNE plant more during the school year, when it is likely to be in heavier use.
- Further investigation of the NTWUT0.2 and NWUTW.2 sites to identify pollutant source(s).
- Continue wet weather sampling on Hall Run and Shayler Run to determine the effectiveness of the sewer system improvements being implemented.
- Others?